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Method for Highly Efficient Preservation Treatment of Fish Meat for Eating Raw

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[Claims]

[Claim 1] A method for highly efficient preservation treatment of fish meat for eating raw, characterized in that:

when performing smoking treatment by allowing smoke produced by fuming a smoking material and filtered to remove tar content and odor from the smoke to come in contact with fish meat for eating raw as object of treatment,

it comprises a process of smoking treatment, wherein a large number of smoke injection needles arranged in parallel at a fixed interval are inserted into the fish meat, and the above smoke injection needles are pulled out while intermittently repeating bubble-like jetting of small amounts of the above smoke from the tips thereof, whereby the above bubbles of smoke are implanted dispersedly into the fish meat,

and fish meat for eating raw is subjected to preservation treatment thereby.

[Claim 2] The method for highly efficient preservation treatment of fish meat for eating raw recited in Claim 1, characterized in that:

in addition to the process of smoking treatment,

it comprises a process of salt addition, wherein a large

1 Numbers in the margin indicate pagination in the foreign text.

number of saline solution injection needles arranged in parallel at a fixed interval are inserted into the above fish meat, and those saline solution injection needles are pulled out while intermittently repeating jetting of small amounts of saline solution from the tips, whereby the above small amounts of saline solution are implanted dispersedly into the fish meat,

and fish meat for eating raw is subjected to preservation treatment thereby.

[Claim 3] The method for highly efficient preservation treatment of fish meat for eating raw recited in Claim 1 or Claim 2, characterized in that:

smoke passing through the filter is contained in an air sac, and the smoke is supplied to the large number of smoke injection needles from that air sac.

[Claim 4] The method for highly efficient preservation treatment of fish meat for eating raw recited in any of Claim 1 through Claim 3, characterized in that:

the fish meat after treatment is held for 20 minutes to 2 hours inside a cooling chamber filled with 0-5°C cooled smoke, and cooled smoke coming in contact with the outer surface of the fish meat is allowed to permeate from the outer surface at the same time as smoke implanted as bubbles by the smoke injection needles is allowed to permeate and diffuse within the fish meat.

[Detailed Explanation of the Invention]

[0001]

[Field of Use in the Industry] The present invention relates to a method for performing highly efficient preservation treatment of fish meat for eating raw, which is used as material for sashimi and sushi.

[0002]

[Prior Art] The present inventors have previously proposed as Japanese Unexamined Patent H6-292503 to make it possible to maintain over a long time the quality of fish meat for eating raw, which is used as material for sashimi and sushi, by smoking treatment at ultra-low temperature. Such treatment of fish meat for eating raw for maintenance of quality cannot be used when the resulting texture, flavor, odor, and the like, of the fish meat for eating raw becomes remarkably different from conventional fish meat for eating raw because the fish meat loses product value for eating raw. The smoking treatment in the above proposal already made is completely different from the conventional method for improvement of preservability of food products by smoking treatment (smoking), in that the quality-maintaining treatment by low temperature smoking is performed within a range that can be adapted sufficiently for eating raw such as for sashimi, without the texture, flavor, odor, and the like, of the fish meat for eating raw differing especially

from conventional fish meat for eating raw.

[0003] In the method for smoking fish meat for eating raw pertaining to this proposal by the present inventors, namely, the ultra-low temperature smoking treatment method, smoke is produced by fuming in a fixed temperature zone, this is passed through a filter to filter out unwanted odor and tar component, then it is passed through a cooling pipe and cooled to 0-3°C, led into a sealed, low-temperature smoke chamber, and made to come in contact with slices of raw fish meat arranged on top of a grill inside the smoke chamber, whereby smoking treatment is performed at ultra-low temperature. Thus, it was understood that in this method, when the slices of fish meat are as thin as sashimi, the treatment can be completed in a comparatively short time, but when thick slices for highly efficient treatment of fish meat for eating raw, and the like, are taken as object, considerable time is required for the smoke to permeate fully.

[0004] To explain this concretely, Fig. 1 shows the change of the condition of permeation of smoke in fish meat (tuna) in an experiment of ultra-low temperature smoking treatment performed by the present inventors. The horizontal axis shows the permeation time of smoking treatment, and the vertical axis shows the degree of permeation (depth of permeation) of the smoke. Average values of these data are

shown, as the results of repeated experiments generally showed the same trend.

[0005] This experimental example is of a case in which the fish meat was arranged on a grill and housed inside a smoke chamber, this smoke chamber was sealed and filled with low temperature smoke, and the pressure inside the smoke chamber was adjusted to pressures given on the respective curves. "10^{-2}-30 atoms" in the drawing is an example of a case in which depressurization and pressurization was repeated between the two pressures each 3 minutes. The used fish (tuna) was treated for prevention of drip runoff by immersing in advance in saline solution to contrive gelling of the body fluid inside the fish meat and lowering the salt concentration by washing with water to the extent that the saltiness cannot be sensed as texture and flavor (0.8% or lower).

[0006] As is clear from the experimental results in Fig. 1, there is a trend that the permeation rate becomes faster as the pressure becomes higher when pressurized to various pressures from 1 atmosphere up to 30 atmospheres, although a difference in permeation rate arises depending on the temperature and pH, and the like, of the fish meat itself. Also, although the data are not shown, when the smoke chamber is depressurized, the permeation becomes faster than the above pressurization even at reduced pressure of 0.5

atmospheres. Furthermore, when depressurization and pressurization are repeated, the permeation of smoke becomes even faster.

[0007] However, in any case, although the smoke permeates considerably rapidly in the initial 1-2 hours, the permeation rate after that is lowered extremely. For example, in the case of 1 atmosphere, although it permeates about 7mm up to the initial 2 hours, it permeates about 12mm in 12 hours and about 15mm in 24 hours, and that which permeates about 7mm in the initial 2 hours requires 24 hours to permeate about twice as far to 15mm. Also, in the case

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of 30 atmospheres, that which permeates about 10mm in the initial 1 hour requires 6 hours to permeate 5mm after that. Accordingly, for thick fish meat, for example quartered tuna having 15-10cm thickness, the above smoking treatment cannot be adapted thoroughly.

[0008] Thus, although the smoke permeates fully to the core of the piece of fish meat in a comparatively short time in the case of thin pieces of fish meat, this permeation time (during this time it cannot be kept at a freezing temperature) becomes increased extremely as the thickness of the piece of fish meat becomes greater. Moreover, with raw fish meat, if it is not kept in a frozen state, the drip runs off with the passage of time and it turns color, and at

the same time, the flavor and texture are markedly decreased. Also, lowering of freshness with the passage of time cannot be avoided, and sanitary problems such as bacteria make it difficult to eat raw.

[0009] From the above results, it was learned that the method which repeats depressurization and pressurization is good for speeding up the permeation of the smoke in order to complete the smoking treatment in an early period, but thick fish meat cannot be treated in a short time to a fully satisfactory extent, and the drip runs off in large quantities causing problems in texture and taste, and in addition, there is a problem that apparatus becomes complex and expensive in order to repeat depressurization and pressurization. Accordingly, in order to maintain flavor, texture, and freshness to the extent that it cannot be distinguished from raw sashimi or higher than this, shortening of the smoking time and more complete permeation of the smoke into the fish meat become indispensable conditions.

[0010] Meanwhile, the present inventors have confirmed that by allowing a saline solution at or below 0.8% which cannot be sensed by the human tongue to permeate the fish meat, gelling of the body fluid of the fish meat due to the salt progresses rapidly and an effect of preventing drip beyond expectation is obtained, moreover the flavor becomes better

and it becomes more delicious than conventional sashimi. Salting and salt removal must be performed for this permeation of saline solution, and considerable time is required also for permeation of the saline solution to a certain extent, but even with that, uniform permeation is not expected. Fish meat differs from pork, and the like, in that salting and salt removal over a long period are not possible, and it can no longer be used for eating raw in a comparatively short time. The reason why is because the meat becomes soggy and is no longer fit for eating raw such as sashimi. Therefore, because it invariably becomes a short period of permeation, the effects of salting and salt removal become smaller. Accordingly, if it is made such that the salting which requires this time can be completed in a slight time, the effect of preventing drip during smoke permeation treatment can be obtained, and the flavor of the fish meat for eating raw can be greatly improved.

[0011]

[Problems the Invention Attempts to Solve] The technical problem of the present invention is to obtain a method for highly efficient preservation treatment of fish meat for eating raw, which accomplishes shortening of the time of smoking treatment and shortening of the time of salting of fish meat and furthermore realizes more complete permeation of the smoke and saline solution.

[0012]

[Means for Solving the Problems] The method of the present invention for solving the above problems, being a method for highly efficient preservation treatment of fish meat for eating raw, fundamentally is characterized in that: when performing smoking treatment by allowing smoke produced by fuming a smoking material and filtered to remove tar content and odor from the smoke to come in contact with fish meat for eating raw as object of treatment, it comprises a process of smoking treatment, wherein a large number of smoke injection needles arranged in parallel at a fixed interval are inserted into the fish meat, and the above smoke injection needles are pulled out while intermittently repeating bubble-like jetting of small amounts of the above smoke from the tips thereof, whereby the above bubbles of smoke are implanted dispersedly into the fish meat, and fish meat for eating raw is subjected to preservation treatment thereby. Also, the present invention is characterized in that: in addition to the above process of smoking treatment, it comprises a process of salt addition, wherein a large number of saline solution injection needles arranged in parallel at a fixed interval are inserted into the above fish meat, and those saline solution injection needles are pulled out while intermittently repeating jetting of small amounts of saline solution from the tips, whereby the above

small amounts of saline solution are implanted dispersedly into the fish meat, and fish meat for eating raw is subjected to preservation treatment thereby.

[0013] To explain this more concretely, in the method of the present invention, first, in order to produce the smoke being the initial ingredient, the smoke is produced by fuming a smoking material at 250-400°C in a smoke chamber. For that, a smoke chamber 1 as exemplified in Fig. 2 is used. This smoke chamber 1 has a fuming platform 12 equipped with a heater 13 with thermostat for fuming the smoking material inside a main unit 10 thereof, and it is made such that the production of smoke by this heater 13 can be controlled while measuring the fuming temperature. Also, air regulators 14 placed above and below a door 11 of the above smoke chamber are constituted by having a number of air holes 15 and having a sliding-capable regulating plate 16 for regulating the aperture of those air holes 15, whereby the amount of air supplied for fuming is made capable of being regulated, whereby the smoking material can be fumed at a required temperature with a small amount of air, and the smoke temperature for producing the necessary smoke ingredient is set by temperature control by the above heater 13.

[0014] Although the smoking material is caused to produce smoke at 250-400°C as described above, it is known that the

ingredients in the smoke differ according to the temperature when fuming that. The temperature range of 250-400°C used for smoke production in the present invention was learned experientially and experimentally by the present inventors as the temperature for effectively producing the gas ingredient suitable for the purpose of the present invention. If the smoking treatment of fish meat described later is performed using smoke produced at this temperature, excellent preservative and disinfecting effects can be provided, and furthermore an effect of preventing discoloration due to oxidation can be provided. As smoking materials, all kinds of trees generally used for smoking treatment can be used, for example, oak, Japanese oak, beech, cherry, alder, linden/basswood, Mongolia oak, walnut, chestnut, white birch, hickory, popular, plane tree, and others can be used.

[0015] The smoke produced in the above smoke chamber 1 next is introduced into a smoke filter device 2 provided on the smoke discharge path of the

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smoke chamber 1, the produced smoke is passed through filters 22, mainly to remove the tar component and odor in the smoke, and smoke containing ingredients having high preservative, disinfecting, and discoloration inhibiting effects is allowed to pass. As the filters 22, all kinds of

well-known filters in places for capturing comparatively large smoke particles consisting mainly of tar components can be used singly, or those having different meshes, and the like, can be used in combination, and an integrated unit can be constituted by layering the necessary number of filters 22 and housing inside a cylinder body 21 having a fixed length.

[0016] By removing the larger part of the tar component and odor in the smoke with these filters 22, when smoking treatment is performed by allowing that smoke to come in contact with fish meat for eating raw such as tuna which is the object of treatment, it is possible to provide preservative, disinfecting, and discoloration preventing effects in a condition having preserved a substantially raw state without rendering excessive odor, flavor, and color, and at the same time, it is possible to provide a suitable extent of flavor and odor within a range that preserves the above raw state. Also, by this smoking treatment, it is possible to remove carcinogenic substances which are considered to be plentiful in the tar component.

[0017] On the output side of this smoke filter device 2, a suction device such as a vacuum pump is connected by means of a pipe 23, and smoke drawn out by that is cooled by a cooling device to become cooled smoke at an ultra-low temperature of 0-5°C in general and preferably 1-3°C, and it

is used as smoke for introducing into a cooling chamber for temporarily housing the fish meat for diffusion of smoke after the process of smoking treatment. This smoke can be used for allowing it to come in contact with the fish meat for eating raw in the process of smoking treatment, but because the treatment is completed in a very short time in the process of smoking treatment, it is not necessary to use cooled smoke in particular.

[0018] As the smoke cooling device, a device having a snaking cooling pipe for passing smoke drawn by the above suction device into a cooling tank filled with coolant such that smoke is passed through this cooling pipe whereby it is cooled and is sent out as 0-5°C smoke can be used. Also, it can be such that the smoke drawn out by the above suction device is contained in an air sac such as a vinyl bag or a suitable container, that if necessary being stored in a refrigeration device and cooled to about 0-5°C, this air sac or container in the process of smoking treatment is connected to a smoke supply port of a smoke implanting device described below, and the cooled smoke contained in that is allowed to come in contact with fish meat for eating raw. When cooling of this smoke is not needed is as explained next.

[0019] In the process of smoking treatment, it is noticed from the aforementioned experimental example that the degree

of permeation of smoke into fish meat in the initial 1 hour is 4mm or more regardless of atmospheric pressure, increased pressure, and the like. Using a smoke implanting device 3 as shown in Fig. 3 and Fig. 4, a large number of smoke injection needles 32 arranged in parallel at a nearly fixed interval (for example a 5mm interval) having considered the above degree of permeation are inserted into the fish meat M small amounts of the above smoke are jetted in a bubble-like manner from the their tips, that jetting is us repeated intermittently while pulling out the smoke injection needles 32, and a fixed amount of smoke is implanted at a fixed interval, whereby the bubbles of small amounts of smoke are implanted dispersedly into the fish meat, and that is allowed to permeate and diffuse uniformly into the fish meat M.

[0020] The above smoke implanting device 3, as shown in Fig. 4, is one in which a large number of injection needle support members 31 having a large number of smoke injection needles 32 arranged in parallel at a fixed interval (for example a 5mm interval) are arranged such that the respective injection needles 32 are positioned between adjacent injection needles 32 in adjacent injection needle support members 31, that is, such that the injection needles 32 become at odds with each other, whereby several tens to several hundreds of the above smoke injection needles 32 are

arranged regularly at a fixed interval in a large number of rows and a large number of columns in an implanting device main unit 30 constituted by the above large number of injection needle support members 31, and smoke passing through holes inside the smoke injection needles 32 is injected at a fixed interval into the fish meat M in which they are inserted. A smoke supply pipe 33 is provided in order to introduce smoke delivered through the aforementioned smoke filter device 2 or smoke cooling device, or smoke stored contained in an air sac such as a vinyl bag, to the respective injection needle support members 31.

[0021] When introducing smoke from the above smoke filter device 2 or cooling device, a smoke pipe may be connected to the smoke supply pipe 33, but when introducing smoke stored contained inside an air sac such as a vinyl bag, the smoke can be supplied to the smoke injection needles 32 with that air sac being removably installed on the smoke supply pipe 33 and being replaced successively when the smoke runs out. This smoke, according to need, can be supplied being pressurized to about 5-10kg/cm^2 by a pressurizing device provided on the smoke supply pipe 33.

[0022] On each of the above injection needle support members 31, as shown in Fig. 3, a movable valve 34, comprising a large number of air chambers 35 having a

capacity necessary for delivering one bubble of smoke being arranged in parallel corresponding to the large number of smoke injection needles 32, is provided so as to be moved back and forth freely in the direction of the arrow by a drive device not illustrated. Each air chamber 35 in this movable valve 34 is provided with a supply hole 38 which is opened or closed to an individual channel 37 from a distributor 36 which communicates with the smoke supply pipe 33 by movement of that movable valve 34, and an injection hole 40 which is opened or closed to an injection channel 39 which communicates with the smoke injection needle 32 by movement of the movable valve 34. The above individual channel 37 and the supply hole 38 are communicating when the movable valve 34 is at one end of movement (left end), and they are non-communicating as shown in Fig. 3 when it is at the other end. Also, the injection channel 39 communicating with the smoke injection needle 32 and the injection hole 40 are non-communicating when the movable valve 34 is at one end of movement and the above individual channel 37 and the supply hole 38 are communicating, and conversely, they are communicating when the individual channel 37 and the supply hole 38 become non-communicating.

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[0023] Furthermore, the above smoke implanting device 3 is connected by a drive member 41 which raises and lowers that

implanting device main unit 30 by a drive device not illustrated. This drive member 41, after the smoke injection needles 32 were inserted deeply into the fish meat M by its downward movement, is driven intermittently, that is, each time a small amount of smoke is jetted in a bubble-like manner from the tips of the smoke injection needles 32 inserted into the meat, by a fixed interval (for example 5mm) in the direction of pulling the smoke injection needles 32 out from the fish meat M. As a result, as shown in Fig. 5, in the tracks 50 of the smoke injection needles 32 inside the fish meat M, the smoke bubbles 51 are implanted in a state distributed nearly uniformly both within the plane of arrangement (horizontal plane) of the injection needles 32 and in the thickness direction of the fish meat. It is not necessary that the above drive member 41 be driven intermittently, and it is also possible to perform implanting of smoke at a fixed time interval while being driven continuously.

[0024] Implanting of the smoke bubbles 51 should be done by driving the aforementioned movable valve 34 back and forth in the direction of the arrow by the drive device. That is, in Fig. 3, when the movable valve 34 is moved to the position shown in the same drawing, from the state in which the movable valve 34 is at the left end and the individual channel 37 and the supply hole 38 are communicating and each

air chamber 35 is filled with pressurized smoke, and the injection channel 39 is made to communicate with the injection hole 40, the smoke filled into each air chamber 35 is sent out through the smoke injection needles 32 by the pressure. When the movable valve 34 is restored to the left end after sending out this smoke, the individual channel 37 and the supply hole 38 again are communicating, and pressurized smoke is filled into each air chamber 35.

[0025] Also, in order to inhibit bending and breaking of the smoke injection needle 32 when it is inserted into the fish meat, a needle guide 43 having a guide hole 44 for inserting each smoke injection needle 32 is provided on the above implanting device main unit 30. This needle guide 43 is held on the implanting device main unit 30 by an elevator arm 45 whereby the driving up and down is controlled. When the smoke injection needle 32 begins descent for insertion into the fish meat M by the drive member 41, it is in a position near the tip of the injection needle 32 as shown in Fig. 3. From the time when the needle guide 43 moves downward together with the drive member 41 and comes in contact with the fish meat M, it is held in the state being stopped at that position. Also, when the smoke injection needle 32 is pulled out from the fish meat M, it holds down the surface of the fish meat and inhibits lifting up of the fish meat together with the smoke injection needle 32.

After the part near the tip of the smoke injection needle 32 reaches the guide hole 44 of the needle guide 43, it is moved upward together with the smoke injection needle 32.

[0026] In order to automate the implantation of smoke into the fish meat, it becomes that implantation of smoke into the fish meat M is performed while the fish meat is moved intermittently by a conveyer which is synchronized with the raising and lowering of the drive member 41. However, relatively the same operation as insertion of the smoke injection needles 32 into the fish meat M by the above drive member 41 can be accomplished with the above implanting device main unit 30 being kept in a fixed state and a platform for the fish meat being raised and lowered. In this case, it becomes that the above needle guide 43 also performs relatively the same movement as in the case previously described.

[0027] Because the bubbles of smoke implanted into the fish meat at a fixed interval diffuse up and down, left and right, within the fish meat, they can be made to permeate throughout the fish meat with 20 minutes to 2 hours, desirably 30 minutes to 1 hour by appropriate setting of the vertical and horizontal intervals of the smoke injection needles 32 and the implantation interval of the bubbles by the drive member 41. Conversely speaking, the interval between bubbles which is determined by the interval of the

above smoke injection needles 32 and the interval of jetting of bubbles during movement of the drive member 41 must be set to an interval such that the bubbles of smoke implanted dispersedly permeate throughout the fish meat within 20 minutes to 2 hours, desirably 30 minutes to 1 hour.

[0028] However, if the interval is contracted beyond need, not only do more smoke injection needles become necessary, but also a larger number of bubbles comes to be implanted, moreover because the pressure inside the fish meat rises between the smoke injection needles 31 and bubbles entering into the fish meat, it becomes necessary to increase the pressure for implanting the smoke, and it comes to influence the strength or bending of the needles. On the other hand, if the implantation interval of the bubbles becomes too large, while it is obvious, time for permeation throughout the fish meat becomes necessary. Accordingly, it must be set appropriately while considering the operating temperature and other conditions.

[0029] Also, the amount of smoke implanted as bubbles into the fish meat is set as the minimum amount necessary for permeation throughout the fish meat, such as by the capacity of the air chambers 35 in the aforementioned movable valve 34 and the pressure of the smoke supplied to there. If the air chambers 35 are provided with a mechanism that can adjust the capacity from outside, it can be adjusted more

easily. Since these smoke bubbles are allowed to disappear completely by permeation into the fish meat, implanting beyond need must be avoided.

[0030] The size of the smoke injection needle 32 is desirably 1mm or less in diameter because of the track left in the fish meat M by that injection needle, the injection pressure of the smoke, the strength against bending of the injection needle 32, and the like. Regarding the smoke injection needle 32, it is better if the size is narrower from the viewpoint of not leaving a track in the fish meat M, but even when using a needle of special steel having high strength, when a large number of injection needles are simultaneously implanted in tuna meat having a thickness of 15cm, the limit is a diameter of about 0.8mm, and if it is not at least that, the needles bend or break and use is difficult.

[0031] In the case of ordinary tuna meat, if the injection needles are implanted in the direction of the muscle fiber, the force on one needle having a diameter of 1mm is about 140-150g, but when the injection needles are implanted in the direction orthogonal to that, the force on one needle having a diameter of 1mm becomes about 450g more or less. Therefore, it is understood that if one attempts to insert the smoke injection needles 32 from an arbitrary direction with thick fish meat as object, the strength of the

injection needles 32 must be increased. Also, as for the shape of the injection needle 32, in order to allow the smoke to diffuse and permeate rapidly and uniformly throughout the meat, it is more

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desirable to use a bag needle as shown in Fig. 6, but there is no problem even if it is in the shape of an ordinary injection needle having a diagonally cut tip.

[0032] Next, the process of salt addition which is performed before or after the above process of smoking treatment is explained. This process of salt addition is substantially the same method as the aforementioned implantation of smoke, and a saline solution which is thin enough (0.8% or lower) that the saltiness cannot be sensed as texture and flavor (seasonings, spices, vitamin C, and the like, can be included according to need) is implanted using saline solution injection needles, whereby the flavor is markedly improved, and in addition, gelling of the water inside the fish meat is promoted rapidly, and a drip preventing effect is promoted. In particular, if this addition of salt is performed, because of the above gelling of the water content, it can be finished such that not only the needle tracks of the aforementioned smoke injection needles 32 but also the needle tracks of these saline solution injection needles cannot be observed by eye. Also,

as effects of the above-described addition of salt, generally, improvement of preservability of the fish meat, expression of water retention and binding, fixing of color of the fish meat, improvement of flavor, and the like, can be mentioned, but it is believed that mainly nitrates and nitrites which are trace ingredients in the salt function for fixing of color and improvement of flavor, and the salt itself functions for drip prevention due to expression of water retention and binding.

[0033] For this addition of salt, a saline water implanting device having substantially the same function as the aforementioned smoke implanting device 3 but only having the object of implantation and the amount of implantation made different is used. By that, a large number of saline solution injection needles arranged in parallel at a fixed interval are inserted into the above fish meat, and those saline solution injection needles are pulled out while intermittently repeating jetting of small amounts of saline solution from the tips, whereby implantation of the above small amounts of saline solution dispersedly into the fish meat is performed. The operation of the saline solution implanting device is substantially the same as the aforementioned smoke implanting device. If the necessary amount of saline solution is implanted into the fish meat in this manner, the salt can be allowed to permeate throughout

the fish meat, just the same as the aforementioned smoke, without water content more than necessary being given to the fish meat as with salting, and an excellent drip-preventing effect during smoke permeation treatment is obtained. Also, the fish meat does not become soggy and become unfit for eating raw such as sashimi.

[0034] The above fish meat after smoking treatment and salt addition treatment must be kept without freezing for 20 minutes to 2 hours in order to allow the implanted smoke and saline solution to permeate and diffuse throughout the fish meat. In order to allow smoke to permeate to a suitable degree also on the surface of the fish meat using this time, it is desirable that the fish meat after the above treatment be housed for 20 minutes to 2 hours inside a cooling chamber filled with cooled smoke of 0-5°C, whereby the low temperature smoke contacting with the outer surface of the fish meat can be allowed to permeate from the outer surface, and at the same time, the smoke and saline solution implanted as bubbles can be allowed to permeate and diffuse inside the fish meat and be allowed to disappear. In this case, the meat <typo in source> should be housed in a state arranged on top of a grill inside a smoking chamber as in the conventional methods, and made to contact with cooled smoke introduced from the above smoke cooling device. If there is no need for smoke contact on the outer surface, it

is possible also to simply keep it in a temperature controlled state inside the above cooling chamber without filling the cooling chamber with cooled smoke.

[0035] In the process of smoking treatment and the process of salt addition described above, as well as in other processes for allowing the smoke and saline solution to permeate and diffuse within the fish meat, it is not preferable that the fish meat be kept at a high temperature. Therefore, it is desirable to perform treatment at a temperature of about 0-5°C, but in particular, because the above process of smoking treatment and process of salt addition have very short treatment times, and treatment within one minute is possible, there is no problem whatsoever even if treated at room temperature. Also, in the processes for allowing the smoke and the saline solution to permeate and diffuse within the fish meat, because the time can be shortened as the temperature becomes higher, it should be set appropriately with those considerations. Also, regarding the above smoke and saline solution implanted in the fish meat, the amount implanted, concentration, and interval of implantation, and the like, can be made freely controllable by computer, whereby it becomes possible to perform mechanical adjustment in a flash.

[0036] In the human eating lifestyle, an eating lifestyle

without salt is not at all imaginable, and it would not be an exaggeration to say that salt is used in all cooked and prepared products. Also, in vegetables and all kinds of other raw food products, the addition of salt to the extent that the saltiness cannot be sensed greatly improves the flavors of those food products. For example, in eggplants and cucumbers, the addition of some salt and furthermore pickling overnight using salt are effective for further improving the flavor more so than when in the unsalted raw state. This fact is the same regardless of whatever cooking. The present invention is by entirely the same principle, and instead of adding soy sauce and horseradish to sashimi made by cutting raw fish and not applying any art whatsoever and eating, there is now provided sashimi having improved flavor corresponding to pickling eggplant overnight, moreover that can be realized while increasing the preservability.

[0037]

[Working Examples] Below, a working example of the method for highly efficient preservation treatment pertaining to the present invention is shown. Smoke produced by fuming a smoking material inside a smoke chamber as shown in Fig. 2 was implanted in slices of tuna by a smoke implanting device substantially as shown in Fig. 3 and Fig. 4. For the smoke injection needles, those having a diameter of 1mm were used,

their interval was made about 5mm in both directions, and the interval of jetting of bubbles from the smoke injection needles was made about 4mm. Also, 0.8% saline solution was implanted into the tuna immediately after performing implantation of smoke by a saline solution implanting device having substantially the same function as the above smoke implanting device. For the permeation time of the smoke, although about 40 hours at 0°C and about 25-30 hours at 3°C are required for permeation to the core of the raw tuna having a thickness of 3cm, in this example, the implantation of smoke and saline solution could be completed in several tens of seconds, and their disappearance through diffusion could be completed in about 30 minutes in a 3°C cooling chamber. Also, a texture

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and taste as good as or better than raw tuna could be obtained without drip runoff or turning of the color of the meat. Furthermore, even when the treated pieces of meat were cut, not only the needle tracks of the smoke injection needles but also the needle tracks of the saline solution injection needles, could not be observed by eye.

[0038]

[Effect of the Invention] According to the method of the present invention as explained in detail above, a method for highly efficient preservation treatment which accomplishes

shortening of the time of smoking treatment and shortening of the time of salting of fish meat and furthermore realizes more complete permeation of the smoke and saline solution can be obtained. Also, by the above-described salt addition treatment, the flavor of the fish meat for eating raw is improved, and in addition, drip runoff in the meat pieces after treatment is inhibited, and it can be put into a state in which not only the needle tracks of the smoke injection needles but also the needle tracks of the saline solution injection needles cannot be observed by eye.

[Brief Explanation of the Drawings]

[Fig. 1] is a graph showing the change over time of the condition of permeation of smoke in fish meat in an experiment of ultra-low temperature smoking treatment performed by the present inventors.

[Fig. 2] is a sectional view of a smoke chamber used for producing smoke as an initial ingredient in the method of the present invention.

[Fig. 3] is a sectional view showing the constitution of a smoke implanting device used in an embodiment of the present invention.

[Fig. 4] is a bottom view showing the state of arrangement of smoke injection needles in the same smoke implanting device.

[Fig. 5] is an explanatory drawing showing the manner of

implanting of bubbles of smoke into fish meat from the smoke injection needles.

[Fig. 6] is an elemental sectional view showing one example of the above smoke injection needle.

[Explanation of the Symbols]

M Fish meat

1 Smoke chamber

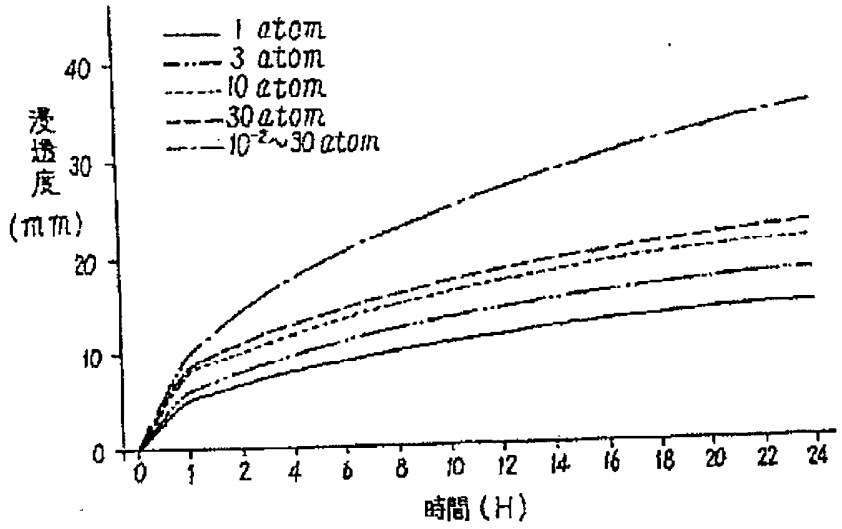
2 Smoke filter device

3 Smoke implanting device

22 Filter

32 Smoke injection needle

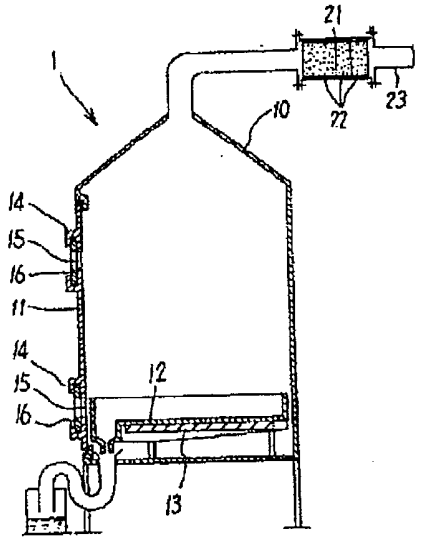
51 Bubble



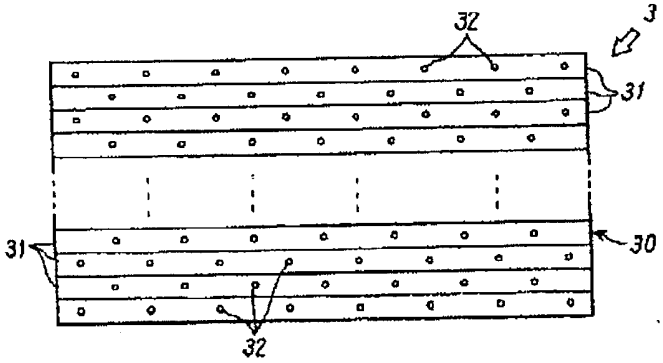
[Fig. 1]

<vertical> Degree of permeation (mm)

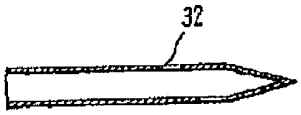
<horizontal> Time (H)



[Fig. 2]



[Fig. 4]



[Fig. 6]

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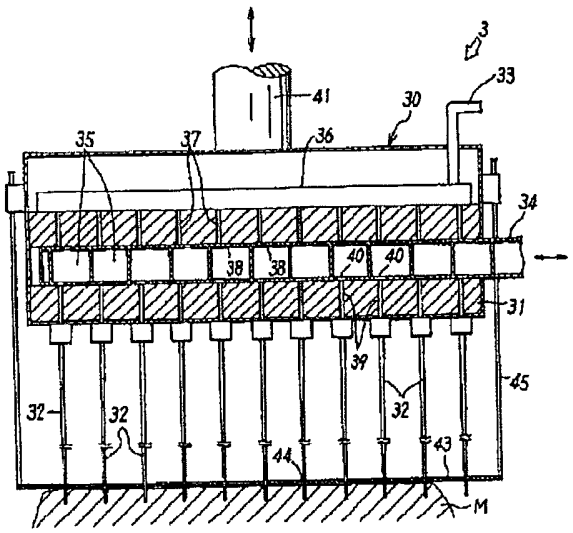
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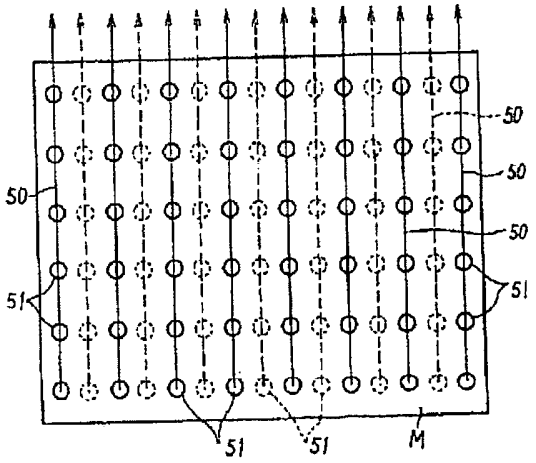
[Fig. 3]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[Fig. 5]